

Table 1: p17

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p17(18-26 IIIB)	p17(18-26)	KIRLRPGGK	HIV-1 infection	human(A3)	[Wilkes et al.(1996)]
		• Epitope defined in the context of the Pediatric AIDS Foundation ARIEL project mother-infant HIV transmission study			
		• KIRLRPGGR and RIRLRPGGR, naturally occurring variants, were found in mother, and are not recognized			
p17(18-26 IIIB)	p17(18-26)	KIRLRPGGK	HIV-1 infection	human(A3)	[Goulder et al.(1997a)]
		• Identical twin hemophiliac brothers were both infected with the same batch of factor VIII			
		• One had a response to this epitope, the other did not			
p17(18-26 LAI)	p17(18-26)	KIRLRPGGK	HIV-1 infection	human(A3.1)	[Harmer et al.(1996b)]
p17(18-27 LAI)	p17(18-27)	KIRLRPGGK	?	human(B27)	[Brander & Walker(1997a)]
		• D. Lewinsohn, pers. comm.			
p17(18-31)	p17(18-31)	KIRLRPGGKKKKYKL	HIV-1 infection	human(B62)	[Lubaki et al.(1997)]
		• 82 HIV-1-specific CTL clones from 5 long term non-progressors were isolated and analyzed for breadth of CTL response			
		• A sustained Gag, Env and Nef response was observed, and clones were restricted by multiple HLA epitopes, indicating a polyclonal response			
		• A subject who was HLA-B62+ had CTL that recognized this peptide, and p24 LGLNKIVRMYS, and one additional unknown epitope			
p17(18-42 IIIB)	p17(18-42)	KIRLRPGGKKKKYKL-K HIVWASRELE	HIV-1 infection	human(A3)	[Jassoy et al.(1992)]
		• Epitope recognized by CTL clone derived from CSF			
p17(18-42 BH10)	p17(18-42)	KIRLRPGGKKKKYKL-K HIVWASRELE	HIV-1 infection	human(Bw62)	[Johnson et al.(1991)]
		• Gag CTL response was studied in three individuals; optimal peptides for binding were mapped by peptide competition			

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p17(18-42 PV22)	p17(18-42)	KIRLRPGGKKKYKLK- HIVWASRELE	HIV-1 infection	human(A3)	[Jassoy et al.(1993)]
		• HIV-1 specific CTLs release γ -IFN, and α - and β -TNF			
p17(91-105 SF2)	p17(20-35)	CLRPGGKKKYKLKH- V	HIV-1 infection	human(unk)	[Lieberman et al.(1997)]
		• Of 25 patients, most had CTL specific for more than 1 HIV-1 protein • 12 subjects had CTL that could lyse vaccinia expressed LAI gag • One of these 12 had CTL response to this peptide • The responding subject was HLA A-2, A-24, B-13, B-35			
p17(19-27 LAI)	p17(19-27)	IRLRPGGKK • D. Lewinsohn, pers. comm.	?	human(B27)	[Brander & Walker(1997a)]
p17(20-29 HB)	p17(20-29)	RLRPGGKKKY	HIV-1 infection	human(B42)	[Wilkes et al.(1996)]
		• Epitope defined in the context of the Pediatric AIDS Foundation ARIEL project mother-infant HIV transmission study			
		• RLRPGGKKRY, a naturally occurring variant, was found in non-transmitting mother and is recognized			
		• Binds HLA-A3 and Bw62 as well			
p17(20-29)	p17(20-29)	RLRPGGKKKY	HIV-1 infection	human(A3.1)	[Brander & Walker(1995)]
		• Unpublished, C. Jassoy and Beatrice Culman, pers comm			
p17(20-29 LAI)	p17(20-29)	RLRPGGKKY	?	human(Bw62)	[McMichael & Walker(1994)]
		• Review of HIV CTL epitopes; defined as minimal peptide by titration curve • Also P. Johnson, per. comm.			
p17(20-28)	p17(20-28)	RLRPGGKKK	HIV-1 infection	human(A*03)	[Goulder et al.(1997a)]
		• Identical twin hemophiliac brothers were both infected with the same batch of factor VIII • One had a response to gag A3 epitope RLRRPGGKKK, the other non-responder carried the sequence RLRPGGKKC			

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p17(20-28)	p17(20-28)	RLRPGGKKKK	HIV-1 infection	human(A3)	[Goulder et al.(1997d)]
	• A control CTL line that reacts with this peptide was included in the study				
p17(20-28)	p17(20-28)	RLRPGGKKKK	HIV-1 infection	human(A3)	[Cao et al.(1997)]
	• The consensus peptide of A, B, and D clade viruses is RLRPGGKKKK				
	• The consensus peptide of C clade viruses is RLRPGGKKKH and is equally reactive				
p17(21-35)	p17(21-35)	LRPGGGKKYKLKHIV	?	human(B8)	[Nixon & McMichael(1991)]
	• Two CTL epitopes defined (see also p24(191-205))				
p17(21-35)	p17(21-35)	LRPGGGKKYKLKHIV	HIV-1 infection	human(not B8)	[van Baalen et al.(1996)]
	• Unknown HLA specificity, but not B8				
p17(91-105 SF2)	p17(21-35)	LRPGGGKKYKLKHIV	HIV-1 infection	human(unk)	[Lieberman et al.(1997)]
	• Of 25 patients, most had CTL specific for more than 1 HIV-1 protein				
	• 12 subjects had CTL that could lyse vaccinia expressed LAI gag				
	• One of these 12 had CTL response to this peptide				
	• The responding subject was HLA-A1, A2, B50, B57				
p17(24-32 LAI)	p17(24-32)	GGKKKYKLK	HIV-1 infection	human(B8)	[Sutton et al.(1993)]
	• Exploration of HLA-B8 binding motif through peptide elution; this peptide was studied in detail				
p17(24-32 LAI)	p17(24-32)	GGKKKYKLK	HIV-1 infection	human(B8)	[Rowland-Jones et al.(1993b)]
	• Study of an individual with partially defective antigen processing				
p17(24-32)	p17(24-32)	GGKKKYKLK	HIV-1 infection	human(B8)	[Klenerman et al.(1994)]
	• Naturally occurring variants GGKKKYQLK and GGKKRYRLK may act as antagonists				
p17(24-32)	p17(24-32)	GGKKKYKLK	HIV-1 infection	human(B8)	[Klenerman et al.(1995)]
	• Naturally occurring antagonist GGKKKYQLK found in viral PBMC DNA and RNA				

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p17(24-31)	p17(24-31)	GGKKKYKL	?	human(B8)	[Goulder et al.(1997e)]
		• The crystal structure of this peptide bound to HLA-B8 was used to predict new epitopes and the consequences of epitope variation			
		• The predictions were experimentally confirmed			
		• The anchors for HLA-B8 epitopes, as defined by peptide elution data, are P3 (K), P5 (K/R), and P8 (L)			
		• Structural data suggests that a positive charge at P5 is essential, but that the constraints on P3 may be less severe			
		• Small hydrophobic residues at P2 may be favorable for binding			
		• A spacious F-pocket favors mid-sized hydrophobic residues in the C-term anchor			
p17(24-32)	p17(24-32)	GGKKKYKLK	HIV-1 infection	human(B8)	[Nowak et al.(1995)]
		• Longitudinal study of CTL response; GGRKKYKLK binds to HLA-B8 but is not reactive			
p17(24-31 LAI)	p17(24-31)	GGKKKYKL	HIV-1 infection	human(B8)	[Reid et al.(1996)]
		• The variants 7R: GGKKKYRL, 7Q: GGKKKYQL, 5R: GGKKRYKL, and 3R: GGRKKYKL, were studied			
		• Crystal structures were obtained to study these peptides in the context of HLA-B8, and CTL binding and activity was determined			
		• 3R has been detected in 3 patients, and it abolishes recognition causing extensive conformational changes upon binding including MHC main chain movement			
		• 7Q and 7R alter the TCR exposed surface, and retain some recognition			
		• Reactivity of 5R depends on the T cell clone, this amino acid is embedded in the C pocket of B8 when the peptide is bound			
		• Optimal peptide is 8-mer, not 9-mer, and positions 3, 5, and 8 are the anchor residues			
p17(24-31 LAI)	p17(24-31)	GGKKKYKL	HIV-1 infection	human(B8)	[Price et al.(1997)]
		• A weak CTL response to the index peptide was observed in an HLA-B8+ infected individual			
		• Sequences from the earliest available time point showed that a variant at position 5, an anchor residue, GGKKQYKL, was present			
p17(25-35 SF2)	p17(24-35)	GGKKKYKLKHIV	HIV-1 infection	human(B8)	[Phillips et al.(1991)]
		• Longitudinal study of CTL escape mutants			

Location	WEAU	Sequence	Immunogen	Species (HLA)	References
p17(28-36 LAI)	p17(28-36) • D. Lewisohn, pers. comm.	KYKLKHIVW	?	human(A24)	[Brander & Walker(1997a)]
p17(35-43 LAI)	p17(36-44) • Optimal epitope defined from within p17(30-44), LKHLWASRELERFA • Dominant CTL response in an HIV+ asymptomatic donor was to this epitope • The Phe in the C-term anchor is distinct from the previously defined Tyr for B*3501 C-term anchors	WASRELERF	HIV-1 infection	human(B*3501)	[Goulder et al.(1997b)]
p17(69-93 BH10)	p17(69-93) • Gag CTL response studied in three individuals; optimal peptides for binding were mapped by peptide competition	QTGSEELRSLYNTVA-TLYCVHQRIE	HIV-1 infection	human(A2)	[Johnson et al.(1991)]
p17(71-85 SF2)	p17(71-85) • Of 25 patients, most had CTL specific for more than 1 HIV-1 protein • 12 subjects had CTL that could lyse vaccinia expressed LAI gag • One of these 12 had CTL response to this peptide • The responding subject was HLA A1, A11, B8, B27	GSEELRSLYNTVATL	HIV-1 infection	human(unk)	[Lieberman et al.(1997)]
p17(71-79 LAI)	p17(71-79) • P. Goulder, pers. comm.	GSEELRSLY	?	human(A1)	[Brander & Walker(1997a)]
p17()	p17(74-82) • Defined in a study of the B8 binding motif	ELRSLYNTV	?	human(B8)	[Goulder et al.(1997e)]
p17(77-85 IIIB)	p17(77-85) • HIV IIIB proteins were used to define the range of CTL epitopes recognized by 3 lab workers	SLYNTVATL	?	human(A2)	[Sipas et al.(1997)]
		SLYNTVAVL, a variant found in HIV-1 MANC, was also recognized			
		SLFNTVAVL, a variant found in HIV-1 NY5CG, was also recognized			

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p17(77-85)	p17(77-85)	SLYNTVATL	none	human(A*0201)	[Walter et al.(1997)]
		• HLA-A2 heavy chain and β 2-microglobulin expressed in <i>E. coli</i> were refolded in the presence of this peptide			
		• The HLA-A2-peptide complex elicited HLA-A2 peptide specific CTL response in cells lacking HLA-A2			
		• Suggests that preformed HLA-peptide complexes could provide an alternate to intracellular processing for immunogens			
p17(77-85)	p17(77-85)	SLYNTVATL	<i>in vitro</i> stimulation	human(A2)	[Stuhler & Schlossman(1997)]
		• Keyhole limpet hemocyanin or tetanus toxoid Th epitope co-expression with peptide CTL epitopes on the same APC was required for induction of peptide specific CTL			
p17(76-84)	p17(77-85)	SLYNTVATL	<i>in vitro</i> stimulation	human(A*0201)	[van der Burg et al.(1996)]
		• Slow dissociation rate is associated with immunogenicity			
		• CTL generated by <i>in vitro</i> stimulation of PBMC derived from uninfected individual			
gag(77-85)	p17(77-85)	SLYNTVATL	HIV-1 infection	human(A2)	[Yang et al.(1996)]
		• CD4+ cell lines acutely infected with HIV were studied to determine their susceptibility to lysis by CTL			
		• Clones specific for RT lysed HIV-1 infected cells at lower levels than Env or Gag specific clones			
		• The distinction was thought to be due to lower expression of RT relative to Env and Gag			
		• CTL can lyse infected cells early after infection, possibly prior to viral production			
gag(77-85)	p17(77-85)	SLYNTVATL	HIV-1 infection	human(A2)	[Yang et al.(1997)]
		• CTL inhibit HIV-1 replication at effector cell concentrations comparable to those found <i>in vivo</i>			
		• CTL produced HIV-1-suppressive soluble factors – MIP-1 α , MIP-1 β , RANTES, after antigen-specific activation			
		• CTL suppress HIV replication more efficiently in HLA-matched cells			
p17(77-85 LAI)	p17(77-85)	SLYNTVATL	HIV-1 infection	human(A2)	[Parker et al.(1992), Parker et al.(1994)]
		• Examined in the context of motifs important for HLA-A2 binding			

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p17(77-85 LAI)	p17(77-85)	SLYNTVATL	HIV-1 infection	human(A2)	[McMichael & Walker(1994)]
		• Review of HIV CTL epitopes; defined as minimal peptide by titration curve			
p17(77-85)	p17(77-85)	SLYNTVATL	HIV-1 infection	human(A2)	[Tsomides et al.(1994)]
		• CTL clones recognize naturally processed peptide; peptide abundance corresponded to level of CTL killing			
p17(77-85)	p17(77-85)	SLYNTVATL	Peptide stimulation <i>in vitro</i>	human(A2)	[Stuhler & Schlossman(1997)]
		• A three cell-type cluster consisting of APCs, Th, and CTLs is the minimal regulatory unit required for Th cell-dependent induction of CTLs			
p17(77-85)	p17(77-85)	SLYNTVATL	HIV-1 infection	human(A2)	[Cao et al.(1997)]
		• The consensus peptide of B and D clade viruses and some C strains is SLFNTVATL, a form that is cross-reactive			
p17(77-85)	p17(77-85)	SLYNTVATL	HIV-1 infection	human(A*0201)	[Goulder et al.(1997a)]
		• Identical twin hemophiliac brothers were both infected with the same batch of factor VIII			
		• One had a response to gag A2 epitope SLYNTVATL, the other to pol A2 epitope ILKEPVHGV			
		• Viral sequencing from the twin that had no response to SLYNTVATL indicated his virus had the substituted form SLHNAVAVL			
		• 71% of an additional set of 22 HIV-1 infected HLA-A*0201 positive donors preferentially responded to gag SLYNTVATL			
		• Those individuals with a pol ILKEPVHGV response tended to have mutations in or around SLYNTVATL			
		• An additional subject went from SLYNTVATL responder to non-responder coincident with a switch to the variant SLFNTVATL			
p17(84-92)	p17(84-92)	TLYCVHQRI	HIV-1 infection	human(A11)	[Brander & Walker(1995)]
		• Epitope defined in the context of the Pediatric AIDS Foundation ARIEL project mother-infant HIV transmission study			

HIV CTL Epitopes

Location	W _{EAU}	Sequence	Immunogen	Species(HLA)	References
p17(88-115 ARV)	p17(88-115)	VHQRIEIKDTKEALD-KIEEEQNKSKKKA	HIV-1 infection	human(A2)	[Achour et al.(1990)]
		• B cell epitope HGP-30 also serves as a CTL epitope			
p17(88-115 ARV)	p17(88-115)	VHQRIEIKDTKEALD-KIEEEQNKSKKKA	Combination peptide vaccine	murine BALB/c (H-2 ^d)	[Hamajima et al.(1997)]
		• B cell epitope HGP-30 also serves as a CTL epitope			
		• Vaccine combined HGP-30, V3 loop peptide variants, and CD4 binding site peptide			
		• IL-12 expression plasmid included with the vaccination enhanced the CTL response			
p17(91-105 SF2)	p17(91-105)	RIDVKDTKEALEKIE	HIV-1 infection	human(unk)	[Lieberman et al.(1997)]
		• Of 25 patients, most had CTL specific for more than 1 HIV-1 protein			
		• 12 subjects had CTL that could lyse vaccinia expressed LAI gag			
		• One of these 12 had CTL response to this peptide			
		• The responding subject was HLA-A3, A24, B8, B55			
p17(93-101)	p17(93-101)	EIKDTKEAL	no CTL shown	human(B8)	[DiBrino et al.(1994b)]
		• Examined in the context of motifs important for HLA-B8 binding, predicted epitope based on Achour et al. above			
p17(93-101)	p17(93-101)	EIKDTKEAL	?	human(B8,B60)	[Brander & Walker(1997b)]
		• Per. comm. from A. Trocha and S. Kalatams to C. Brander and B. Walker			
p17(121-132 HXB2R)	p17(121-132)	DTGHSNQVSQNY	HIV-1 infection	human(A33)	[Buseyne et al.(1993)]
		• Clustering of Gag p24 CTL epitopes recognized in 29 HIV infected people			
p17(124-132 LAI)	p17(124-132)	NSSKVSQNY	HIV-1 infection	human(B35)	[McMichael & Walker(1994)]
		• Review of HIV CTL epitopes; defined as minimal peptide by titration curve			
p17(124-132 LAI)	p17(124-132)	NSSKVSQNY	HIV-1 or -2 infection	human(B35)	[Rowland-Jones et al.(1995)]
		• Established by titration; HIV-2 equivalent PPGSKGGNY also recognized in the context of B35 by CTL from HIV-2 seropositives			